

2014 National Federal Laboratory Consortium Award Winners

Novel 'Black Pearl' Pepper Cultivar

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A team of USDA-ARS scientists from the Beltsville Agricultural Research Center's Genetic Improvement of Fruits and Vegetables Laboratory and the U.S. National Arboretum's Floral and Nursery Plants Research Unit developed novel ornamental/culinary pepper (*Capsicum annuum*) breeding material from which they created the award-winning cultivar 'Black Pearl'. 'Black Pearl' is highly drought tolerant and displays colorful fruit and black foliage that provides an attractive display throughout the growing season. 'Black Pearl' overcomes limited seasonal interest and lack of wide adaptability common to other species of dark foliage garden plants. 'Black Pearl' shows

solid, true black-pigmented foliage desired by consumers and produces small black round fruit that are hot, turn red at maturity and can be harvested for culinary spice. Novel peppers have the highest per unit value of any pepper product. 'Black Pearl' provides an alternative high-value crop for greenhouse pot plant/transplant production and an innovative high-value farm crop. 'Black Pearl' is the first successful black foliage pepper with true black pigmentation in the commercial market.

The USDA-ARS research team actively promoted the concept of new pepper ideotypes for ornamental and dual-purpose ornamental/culinary applications. They communicated with leaders in the crop development and production industry and identified prospective partners with the capacity to bring research products to the market. As a result of these efforts, a Cooperative Research and Development Agreement (CRADA) was developed with one of the largest seed companies in the world, Pan America Seed Company, a division of Ball Horticultural Company, to develop novel vegetable germplasm. Material Transfer Agreements were executed for exchange and testing of plant material. Application for and award of U.S. Plant Variety Protection Certificate 200500020 in 2006 for 'Black Pearl' allowed the private partner to obtain exclusive license (U.S. License No. 1381-001) from the USDA Office of Technology Transfer and commercialize the invention.

The commercial pepper cultivar 'Black Pearl' is marketed world-wide in wholesale and retail markets. 'Black Pearl' has been honored with prestigious awards for horticultural quality. 'Black Pearl' was recognized internationally in Europe as a 2005 Quality Award Winner by Fleuroselect, the International Organization for the Ornamental Plants Industry. 'Black Pearl' received twelve additional awards during 2006-2012 including a U.S. 2006 All America Selections award for superior performance in impartial trials conducted across North America.

Expectations of USDA-ARS and private parties were fully met in the creation of a new pepper cultivar that brings new versatility to utilization of vegetables in the garden and landscape. 'Black Pearl' has been widely adopted by the nursery trade, botanic gardens, arboreta and gardeners and has created an increased demand for garden plants with novel foliage color, resulting in their use as standard elements to consider in garden design.

Hatchery Technology for Hybrid Catfish Fry

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Catfish is the most important aquaculture species in the United States, accounting for half of all farmed seafood by value. However, catfish farmers face severe economic challenges and improving farm efficiency is the key to remaining competitive. Hybrid catfish produced by crossing channel catfish females with blue catfish males is a superior fish that grows faster, is easier to harvest, and is more resistant to diseases than the channel catfish. Although the initial cross was made more than 50 years ago, production was limited to “research scale” because hybridization rate, egg hatch rate, and fry survival were too low for commercial interest.

Drs. Brian Bosworth and Nagaraj Chatakondi, with the Warmwater Aquaculture Research Unit at Stoneville, MS, systematically developed a suite of technologies to improve fry production efficiency. Technologies included improvements in broodfish selection; broodfish handling; hormone-induced spawning; blue catfish sperm preparation; egg hatching

technology; egg treatments for disease prevention; and optimizing water chemistry for hatching and fry survival. Technologies were developed in scientific studies at Stoneville and at cooperating farms in Mississippi and Arkansas. Technology was transferred by Drs. Bosworth and Chatakondi through research journal publications (22), trade magazine articles (7), presentations at scientific and industry conferences (20), and hundreds of personal farm visits. The nominees have developed ten non-funded cooperative agreements with farmers, which have been particularly effective as mechanisms for refining technologies for commercial use and enhancing technology transfer. The unique aspect of this technology transfer activity has been aggressive, persistent, and highly effective use of one-on-one farmer training. 1-2 2014 FLC Excellence in TT Award

Two significant examples of hybrid catfish technology are the development and commercial use of a novel “jar-hatching” technology (Dr. Bosworth) and development and use of effective hormone-spawning regimes for improved ovulation in females (Dr. Chatakondi). Currently, of the eight major hybrid fry producers, three use Dr. Bosworth’s technology for all hybrid fry production, two use it for a portion of production, and the other three have indicated they will use the technology in 2014. Approximately half of all hybrid fry produced in 2013, were hatched using the hatching jar approach developed by Dr. Bosworth. In 2009, improved hatchery protocols, developed by Dr. Chatakondi, were demonstrated and, in 2010, adopted by three hybrid producers. The other producers will adopt these improvements in the next two years. Based primarily on research developed and transferred by Drs. Bosworth and Chatakondi, hybrid fry production increased in five years from fewer than 30 million to more than 160 million. The combination of improved fry production and faster growth and better survival during grow-out resulted in hybrids representing nearly 50% of all catfish processed in 2013. Their research has been critical to helping U.S. catfish farmers remain competitive in the global seafood industry.

Pterostilbene: It's Role in Supporting Multiple Health Benefits

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Novel protein and enzyme targets were discovered providing mechanisms for new activities of pterostilbene that promote healthy mind and body functions. Pterostilbene was shown to bring about hypolipidemic, antioxidant, and anti-inflammatory effects in the body. Pterostilbene reduces proteins which become elevated in states of anxiety. It also reduces the build up of fatty acids and reduces lipid synthesis in the liver and adipose tissue. Pterostilbene is a promising natural compound for use in the treatment or reduction of body fat and cholesterol, oxidative stress, neurological dysfunctions associated with aging, anxiety, and obesity. Patents were filed for these novel uses of pterostilbene which included the work of Dr. Agnes

Rimando for the United States Department of Agriculture and scientists from the University of Mississippi who took the lead on licensing the jointly developed technologies. A United States company, ChromaDex, has licensed three of the patents, 1) pterostilbene being a PPAR-alpha agonist, March 31, 2010; 2) improvement of working memory by pterostilbene, March 31, 2010; and 3) reduction of anxiety by pterostilbene, June 3, 2011. Upon licensing the first two technologies, ChromaDex launched pterostilbene to the natural products market under the trade name pTeroPure[®] pterostilbene on April 26, 2010. In June 2011, ChromaDex launched BlūScience[®], its new line of dietary supplements, which feature pTeroPure[®] pterostilbene and blueberry fruit extract in combination with other natural compounds to create products specifically targeting the health benefits. These new products encompassed the patent rights that are licensed from the University of Mississippi under license agreements between the university and USDA.

The technology transfer has resulted in an ever increasing annual sale of pTeroPure[®] pterostilbene, from about a quarter million in 2009, to over \$700,000 after the technology was transferred in 2010, to about \$1,300,000 after market adoption in 2011, to well over \$3,000,000 in 2012. pTeroPure[®] pterostilbene is the first ingredient launched by ChromaDex and has significantly contributed to the growth of the company. The independent market research company, Frost & Sullivan, recognized pTeroPure[®] as the winner of the "2010 North American Ingredients Most Promising Ingredient of the Year" award. The licenses have resulted in more than 30 dietary supplement products currently available for purchase through numerous consumer outlets. The ChromaDex consumer products under the BlūScience[®] line are now sold at major retail outlets, such as Walgreens, GNC, the McKesson conglomerate of independent pharmacies, and online at Drugstore.com. pTeroPure[®] pterostilbene, the branded ingredient from ChromaDex, is now in a wide array of market channels including sports nutrition, major retail, direct to physician, multi-level marketing, direct to consumer, skincare, and food.

Development and Transfer of the Wind Erosion Prediction System

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The first attempt to model agricultural wind erosion was the 1965 Wind Erosion Equation (WEQ) and was based largely on the work of the ARS research program. However, WEQ had severe limitations in adapting to environments beyond the Great Plains and it was cumbersome to use. The National Resources Conservation Service (NRCS) requested that ARS develop a replacement for WEQ. The resulting Wind Erosion Prediction System (WEPS) incorporated 65+ years of advancements in wind erosion science and took advantage of newer computer technology.

WEPS technology allows users, ranging from governmental agencies and researchers to individual farmers, to apply research findings to specific tracts of land to assess wind erosion soil loss. WEPS is a completely packaged model, combining science based computer code and extensive databases with a simple to use interface (Fig. 1) that provides a means to input a basic field description, calculate soil loss,

and display outputs. By varying management inputs, the user can compare alternatives to develop the best strategies for wind erosion control.

The ARS WEPS Core Team developed the model primarily for NRCS and led the technology transfer effort, spending a majority of their time on WEPS over the life of the project. A significant part of the technology transfer was the conversion of wind erosion technical research into a simple to use computer model for any level of user. This team not only converted past research into WEPS algorithms but also conceived an extensive research program to specifically develop equations and databases for WEPS.

WEPS technology was transferred to NRCS by ARS through annual cooperative agreements and quarterly progress meetings. Later in the development of WEPS, 12 NRCS U.S. regional testing sessions were held to obtain feedback on the model. WEPS training sessions were also held at 12 professional society meetings and internationally in Canada and China, as well as numerous regional hands-on, 2-day training workshops specifically for NRCS personnel. Numerous presentations on WEPS technology were also made at international society meetings. The model is available for public download and it is made known to users through peer-reviewed publications, society presentation and workshops, and personal recommendations.

Recipients of WEPS technology include national, state, and local governmental agencies, universities, managers of disturbed lands (e.g., construction and mining), international users, and individual farmers. WEPS was released to the NRCS and general public in 2010 and is installed on 15,000 computers in 2,500 NRCS field offices nationwide and over 560 copies have been downloaded by users in 31 countries. NRCS considers WEPS an essential tool for planning as well as soil quality and energy efficiency assessments. From October, 2012 to June, 2013 alone, NRCS applied WEPS for planning cropland conservation practices on 4.7 million U.S. acres.